

WHAT IS CLAIMED IS:

- 1                   1.     A planar structure expandable into a 3-D structure, the planar  
2     structure comprising:  
3                   first and second spaced side beams which extend along a longitudinal  
4     axis; and  
5                   a plurality of spaced cross-bands which connect the side beams  
6     together wherein a first set of the cross-bands are expandable in a first direction  
7     substantially perpendicular to the longitudinal axis to form a 3-D structure.
- 1                   2.     The planar structure as claimed in claim 1, wherein a second  
2     set of the cross-bands are expandable in a second direction substantially opposite the  
3     first direction to form a mesh-like 3-D structure.
- 1                   3.     The planar structure as claimed in claim 2, wherein adjacent  
2     cross-bands are expandable in the opposite directions to form a mesh-like 3-D  
3     structure.
- 1                   4.     The planar structure as claimed in claim 1, wherein the planar  
2     structure plastically deforms during expansion so that the 3-D structure is free  
3     standing.
- 1                   5.     The planar structure as claimed in claim 2, wherein the planar  
2     structure plastically deforms during expansion so that the 3-D structure has a  
3     cylindrical geometry.
- 1                   6.     The planar structure as claimed in claim 2, wherein the 3-D  
2     structure is a tubular stent.
- 1                   7.     The planar structure as claimed in claim 1, wherein the planar  
2     structure includes a conductive foil.

1                   8.     The planar structure as claimed in claim 1, wherein each of  
2     the cross-bands includes a series of folded beams.

1                   9.     The planar structure as claimed in claim 8, wherein the folded  
2     beams have an involute pattern.

1                   10.    The planar structure as claimed in claim 8, wherein the folded  
2     beams have a switchback pattern.

1                   11.    The planar structure as claimed in claim 8, wherein each of  
2     the cross-bands includes hinges for interconnecting adjacent folded beams.

1                   12.    The planar structure as claimed in claim 1, wherein the side  
2     beams and cross-bands include biocompatible surface coatings.

1                   13.    The planar structure as claimed in claim 1, wherein the side  
2     beams and cross-bands are made of a biocompatible metal.

1                   14.    The planar structure as claimed in claim 1, wherein the cross-  
2     bands are made of a shape-memory alloy and wherein the planar structure is self-  
3     expandable.

1                   15.    The planar structure as claimed in claim 1, wherein the side  
2     beams and cross-bands are made of at least one of a biocompatible and a  
3     biodegradable polymer.

1                   16.    The planar structure as claimed in claim 1, wherein the side  
2     beams and cross-bands are formed by removing material from a sheet of material.

1                   17.    The planar structure as claimed in claim 16, wherein the sheet  
2     of material includes conductive foil and wherein side beams and cross-bands are  
3     formed by electric discharge machining the conductive foil.

1                   18.    The planar structure as claimed in claim 1, wherein at least  
2   the first side beam includes a link portion having a mechanical strength lower than  
3   other portions of the first side beam to allow the first side beam to break at the link  
4   portion during expansion of the first set of cross-bands.

1                   19.    The planar structure as claimed in claim 18, wherein the link  
2   portion is thinned relative to the other portions of the first side beam.

1                   20.    The planar structure as claimed in claim 18, wherein the link  
2   portion is made of a fragile material relative to the other portions of the first side  
3   beam.

1                   21.    The planar structure as claimed in claim 18, wherein the 3-D  
2   structure is a helical coil.

1                   22.    The planar structure as claimed in claim 21, wherein the  
2   helical coil comprises at least one electrical inductor.

1                   23.    The planar structure as claimed in claim 21, wherein the  
2   helical coil includes first and second spaced rings at opposite ends thereof and  
3   wherein each of the rings is formed by an adjacent pair of expanded cross-bands.

1                   24.    The planar structure as claimed in claim 23, wherein at least  
2   the first ring includes a dielectric part which mechanically connects but electrically  
3   insulates adjacent portions of the first ring.

1                   25.    The planar structure as claimed in claim 23, wherein at least  
2   the first ring includes a link portion having a mechanical strength lower than other  
3   portions of the first ring to allow the first ring to break at the link portion during  
4   expansion of the first set of cross-bands to open an electrical path formed by the first  
5   ring.

1                   26. The planar structure as claimed in claim 1, wherein at least  
2 one of the side beams and the cross-bands includes a dielectric part which  
3 mechanically connects but electrically insulates adjacent portions of the at least one  
4 of the side beams and the cross-bands.

1                   27. An assembly comprising:  
2 a planar structure including:  
3 a pair of spaced side beams which extend along a longitudinal  
4 axis; and  
5 first and second sets of spaced cross-bands that connect the  
6 side beams together; and  
7 a balloon mounted on the cross-bands so that adjacent cross-bands are  
8 disposed on opposite first and second sides of the balloon wherein inflation of the  
9 balloon causes the first set of cross-bands on the first side of the balloon to expand  
10 in a first direction and the second set of cross-bands on the second side of the  
11 balloon to expand in a second direction substantially opposite the first direction and  
12 substantially perpendicular to the longitudinal axis to form a mesh-like, 3-D  
13 structure.

1                   28. The assembly as claimed in claim 27, wherein the balloon is  
2 an angioplasty balloon and the 3-D structure is a tubular stent.

1                   29. The assembly as claimed in claim 28, further comprising a  
2 catheter tube in fluid communication with the angioplasty balloon.

1                   30. A device for use in a electric discharge machining system to  
2 form an expandable planar structure from a conductive planar workpiece, the device  
3 comprising:  
4 a substrate; and  
5 a planar electrode formed on the substrate and including a pair of  
6 spaced, side electrode members extending along a longitudinal axis to form a pair  
7 of side beams of the structure from the workpiece and a plurality of spaced cross-

8 band electrode members to form a plurality of spaced cross-bands of the structure  
9 from the workpiece, the cross-bands connecting the side beams together.

1 31. The device as claimed in claim 30, wherein the side electrode  
2 members and the cross-band electrode members comprise a plurality of copper  
3 structures formed by electroplating the substrate.

1 32. The device as claimed in claim 30, wherein the substrate  
2 includes a semiconductor wafer and wherein the side electrode members and the  
3 cross-band electrode members comprise a plurality of semiconductor structures  
4 formed by removing material from the semiconductor wafer.

1 33. The planar structure as claimed in claim 1, wherein the side  
2 beams are substantially straight and continuous.

1 34. The planar structure as claimed in claim 1, wherein the side  
2 beams are substantially straight or continuous.

1 35. The planar structure as claimed in claim 1, wherein the 3-D  
2 structure comprises at least one electrical conductor.